11

SAMPLING TECHNIQUES

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ACKNOWLEDGMENTS

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LECTURE **OBJECTIVES**

By the end of this lecture, I am able to understand:

- Why we use sampling methods
- The definitions of few terms in sampling
- The different sampling and non-sampling methods
- And be able to use sampling methods appropriately in research

SAMPLING & Epidemiology

Definition

Sampling is the process or technique of selecting a study sample of appropriate characteristics and of adequate size. Essential to be able to generalize results in a Population

Why is sampling?

- Unable to study all members of a population
- Reduce selection bias
- Save time and money
- Measurements may be better in sample than in entire population
- Feasibility

Population, Sample and Sampling Frame

-Group of things (people) having one or more common characteristics
-A set which includes all measurements of interest to the researcher (The collection of all responses, measurements, or counts that are of interest)

Population

-**Representative** subgroup of the larger population
-Used to estimate something about a population (generalize)
-Must be similar to population on characteristic being investigated
-A subset of the population.

Sample

-This is the complete list of sampling units in the target population to be subjected to the sampling procedure
-Completeness and accuracy of this list is essential for the success of the study

Sampling Frame

SAMPLING & Epidemiology

Sampling Units

These are the individual units / entities that make up the frame just as elements are entities that make up the population. E.g. Student list, the list is the **sampling frame** while each name in the list is the **sampling unit**

Sampling Error

This arises out of random sampling and is the discrepancies between sample values and the population value. discrepancies means incorrect or lack of compatibility

Sampling Variation

- Due to infinite variations among individuals and their surrounding conditions.
- Produce differences among samples from the population and is due to chance

Example:

In a clinical trial of 200 patients we find that the efficacy of a particular drug is 75%
If we repeat the study using the same drug in another group of similar 200 patients we will not get the same efficacy of 75%. It could be 78% or 71%.
"Different results from different trials though all of them conducted under the same conditions" there will be variability

VALIDITY

Representativeness (validity)

A sample should accurately reflect distribution of relevant variable in population:

PERSON	e.g. sex, age
PLACE	e.g. urban vs rural
TIME	e.g. seasonality

Adequate sample size plus technique would help in generalizability ex. DM in riyadh can be generalized to KSA (precision also called reliability)

Remember!

- **Representativeness essential to generalise**
- Ensure representativeness before starting look for limitations
- Confirm once completed.

Validity of a Study

Two components of validity:

Internal Validity	External Validity
• A study is said to have internal validity when there have been proper selection of study group and a lack of error in measurement. • (relate to (how you select samples what is sample and measurement) • For example, it is concerned with the appropriate measurement of exposure, outcome, and association between exposure and disease.	• External validity implies the ability to generalize beyond a set of observations to some universal statement. • Here your sampling technique plays a big role and you can generalize. internal validity ---->method. external validity ---> generalizability

SAMPLING

Sampling and representativeness

How to Sample

In general, 2 requirements:

1. **Sampling frame** must be available, otherwise develop a sampling frame.

2. Choose an appropriate **sampling method** to draw a sample from the sampling frame

The Sampling Design Process

1	2	3	4	5
Define the population	Determine the sampling frame	Select sampling technique(s)	Determine the sample size	Execute the sampling process

SAMPLING METHODS

Probability Sampling
Simple Random Sampling
Systematic Random Sampling
Stratified Random Sampling
Cluster (Area) Random Sampling
Multistage Random Sampling

It means that everyone member of the sampling population has the same chance to be selected for the study

Non-Probability Sampling
Deliberate (Quota) Sampling
Convenience Sampling
Purposive Sampling
Snowball Sampling
Consecutive sampling

Used for Qualitative Studies

Choosing probability vs. non-probability sampling method

IMPORTANT!!!!!!

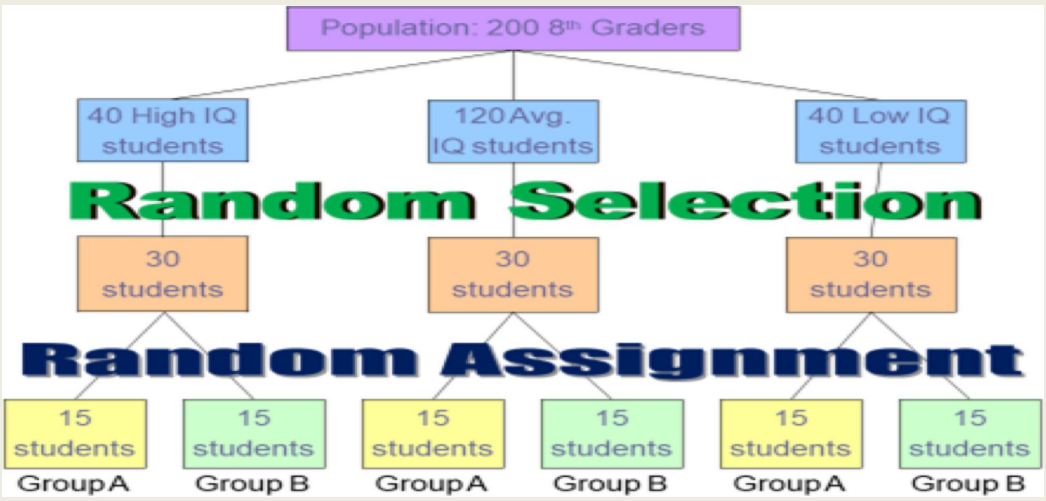
Probability sampling	<- Evaluation Criteria ->	Non-probability sampling
Conclusive	Nature of research	Exploratory
Larger sampling errors	Relative magnitude sampling vs. non-sampling error	Large non-sampling errors
High (Heterogeneous)	Population variability	Low (Homogeneous)
Favorable	Statistical Consideration	Unfavorable
High	Sophistication Needed	Low
Relatively Longer	Time	Relatively Shorter
High	Budget Needed	Low

Homogenous ,Why? Because our sample is not random.

SAMPLE SELECTION

Random selection:

Random Selection	Random Assignment
Every member of the population has an equal chance of being selected for the sample.	-Every member of the sample (however chosen) has an equal chance of being placed in the experimental group or the control group. -Allows for individual differences among test participants to be averaged out. -Used in Experimental Study (RCT)
Explanation:- choosing which potential subjects will actually participate in the study.	Explanation:- Deciding which group or condition each subject will part of



PROBABILITY SAMPLING

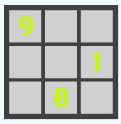
1-Simple Random Sampling

- **Equal probability** each one has a chance of being selected- equal probability
- **Techniques:**

Lottery Method

All names in a drum and choose NOT SCIENTIFIC

Table of Random Numbers



Advantage:

Most representative group

Disadvantage:

Difficult to identify every member of a population

How to select a simple random sample?

1. Define the population
2. Determine the desired sample size
3. List all members of the population or the potential subjects

✓ **For example:** 4th grade boys who have demonstrated problem behaviors and we will be selecting 10 boys from the list

Example

Estimate hemoglobin levels in patients with sickle cell anemia

1. Determine sample size
2. Obtain a list of all patients with sickle cell anemia in a hospital or clinic
3. Patient is the sampling unit
4. Use a table of random numbers to select units from the sampling frame
5. Measure hemoglobin in all patients
6. Estimate the levels (normal & abnormal) of hemoglobin

◄ Example:-

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47			
48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69			
70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91			
92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109							
110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125									
126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141									
142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157									
158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173									
174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189									
190	191	192	193	194	195	196	197	198	199	200														

PROBABILITY SAMPLING

2-Systematic Random Sampling

Technique:

Use "system" to select sample (e.g., every 5th item in alphabetized list, every 10th name in phone book). First number should be random,if your first number is not random it called systematic non random size

Advantage	Disadvantage
-Quick -Efficient -Saves time and energy	-Not entirely bias free; each item does not have equal chance to be selected -System for selecting subjects may introduce systematic error -Cannot generalize beyond population actually sampled

Example

- If a systematic sample of 500 students were to be carried out in a university with an enrolled population of 10,000, the sampling interval would be:
- I = N/n = 10,000/500 =20
- All students would be assigned sequential numbers. The **starting point** would be chosen by selecting a random number between 1 and 20. If this number was 9, then the 9th student on the list of students would be selected along with every following 20th student. The sample of students would be those corresponding to student numbers 9, 29, 49, 69,..... 9929, 9949, 9969 and 9989.
- Select a random starting point and then select every K (th) subject in the population

Example:-

If we have a population of 200 people and we need to take 20 of them as a sample for the research, according to the "Systematic Random Sampling". First we divide the population to the desired sample size 200/20=10. Then we chose a random number from 1-10 to get the first unit, for example 10. After that we add the answer of the equation to the randomized number to get the next unit.

PROBABILITY SAMPLING

3.Stratified Random Sampling

Technique:

Divide population into various strata
all demographic variables are stratification so we stratify to remove confounding bias

Randomly sample within each strata

Sample from each strata should be proportional

Advantage

Better in achieving representativeness on control variable

Disadvantage

-Difficult to pick appropriate strata
-Difficult to Identify every member in population

Divide the population into at least two different groups with common characteristic(s), then draw subjects randomly from each group (group is called strata or stratum)

e.g. Stratified Random selection for drug trial in hypertension

EXAMPLE

Stratified random sample:
Assess dietary intake in adolescents

1. Define three age groups:
11-13, 14-16, 17-19
2. Stratify age groups by sex
3. Obtain list of children in this age range from schools
4. Randomly select children from each of the 6 strata until sample size is obtained
5. Measure dietary intake

PROBABILITY SAMPLING

4.Cluster (Area) random sampling

Technique

Randomly select groups (cluster) – all members of groups are subjects

Appropriate when:

- you can't obtain a list of the members of the population
- Have little knowledge of population characteristics
- Population is scattered over large geographic area

Advantage:
More practical, less costly

simple---> random sampling if large ones ----> cluster sampling

Sample size is number of clusters

Conclusions should be stated in terms of cluster (sample unit – school)

5.Multistage random sampling

STAGE I — Randomly sample clusters (schools)

STAGE III — Randomly sample classrooms from the schools selected

STAGE III — Random sample of students from class rooms

Do not get confused between cluster and stratified variables (all person characteristics of study subject).cluster could be regions of Riyadh (north south west) school AREAS. Multistage of random sampling is extension of cluster random sampling multistage go to cluster and do again random sampling

NON-PROBABILITY SAMPLING

Deliberate "Quota" Sampling

Similar to stratified random sampling.

Technique:
-Quotas set using some characteristic of the population thought to be relevant
-Subjects selected non-randomly to meet quotas (usu. convenience sampling)

Disadvantage:
-Selection bias
-Cannot set quotas for all characteristics important to study

Convenience Sampling
(Haphazard)

-"Take them where you find them" - nonrandom

-Intact classes, volunteers, survey respondents (low return), a typical group, a typical person

Disadvantage:
Selection bias (Most disadvantage)

Purposive Sampling

Purposive sampling (criterion-based sampling)

-Establish criteria necessary for being included in study and find sample to meet criteria.

Solution: Screening

-Obtain a sample of a larger population and then those subjects that are not members of the desired population are screened or filtered out. no methods of convenience

EX: want to study smokers but can't identify all smokers

Snowball Sampling

-In snowball sampling, an **initial group** of respondents is selected.

-After being interviewed, these respondents are **asked** to identify others who belong to the target population of interest.

-**Subsequent** respondents are selected based on the **referrals.** no random methods

Consecutive Sampling

-Outcome of 1000 consecutive patients presenting to the emergency room with chest pain
-Natural history of all 125 patients with HIV-associated TB during 5 year period
-Explicit efforts must be made to identify and recruit ALL persons with the condition of interest

In conclusion....!

For any research, based on its study design and objectives an appropriate random sampling technique should be used.